On the Front Lines: An Environmental Asthma Intervention in New York City

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Asthma is now the leading cause of school absence among children of color in impoverished urban neighborhoods. Environmental interventions have the potential to augment clinical approaches to asthma management by directly reducing exposure to environmental triggers (e.g., cockroaches, rodents, and mold).

We implemented an apartment-based intervention to reduce exposures to indoor allergens among children living with asthma in 2 areas in New York City with rates of asthma morbidity and mortality that rank among the highest in the United States. Although the intervention phase of the present study is not yet complete, timely reporting of our field experiences may prove useful to other groups engaged in environmental intervention trials in urban communities.

ASTHMA IS NOW THE LEADING cause of school absence among children of color in impoverished urban neighborhoods, thereby contributing to decreased quality of life and hindering opportunities for educational and career advancement.[1] Exposure to high levels of indoor allergens (e.g., from cockroaches, rodents, and mold) among allergic asthmatic children results in more frequent and severe asthma episodes.[2] Environmental interventions have the potential to augment clinical approaches to asthma management by directly reducing exposure to environmental triggers.

We recruited 30 asthmatic children aged 5 to 18 years who were allergic to cockroaches and lived in apartments with self-reported cockroach infestation. Each apartment underwent a baseline inspection for the presence of cockroaches and mice and an environmental assessment that included collection of dust samples for later analysis of cockroach, mouse, and dust mite allergens. Individual sensitization was assessed in all enrolled children via skin prick tests and allergen-specific IgE levels. Asthma symptoms were assessed by means of standardized questionnaires.

All homes underwent a comprehensive integrated pest management (IPM) intervention, half at baseline (the intervention group) and the other half 8 months later (the lagged-intervention group); group assignment was random. The intervention consisted of the following: sealing cracks and crevices in the structural envelope of each apartment, applying low-toxicity pesticides, thoroughly cleaning surfaces, eliminating food and water sources, and educating household members about maintaining a pest-free environment. Follow-up assessments of cockroach and rodent populations, allergen exposures, immunologic sensitizations, and asthma symptoms are currently under way. Results from our pilot work were reported previously as abstracts only.[3,4]

DISCUSSION AND EVALUATION

We encountered multiple challenges in the course of conducting this study, 5 of which are discussed below: (1) difficulties in recruiting participants; (2) major disruptions of participating households; (3) the need to involve multiple household members to sustain a pest-free environment; (4) initiation of their own forms of pest management in some lagged-intervention households; and (5) severe structural and maintenance problems in older buildings.

First, the initial recruitment methods, based on informal contacts in Northern Manhattan and the South Bronx, proved to be ineffective, leading to our eventual reliance on clinical contacts at the Columbia Presbyterian Medical Center. To improve participation rates, it may be useful to work with multiple community-based organizations, tenant associations, and health and environmental agencies that are well established in local communities and also provide services for people with asthma.

Second, as the physical and chemical intervention required extensive cleaning and repair

work over a 3-day period while the residents were present, every participating household reported major disruptions. One resident likened it to "a move without going anywhere." Numerous study personnel, including carpenters, cleaners, and environmental researchers, were in each apartment for extended periods.

It was necessary to modify intervention protocols on the basis of evolving field experience. For example, in the initial IPM protocol, only boric acid and diatomaceous earth were used to kill cockroaches; however, because of heavy infestations in the participating apartments, we subsequently augmented these pesticides with chemical gel baits and traps. In addition, we originally planned to intervene in the entire apartment, but later targeted our efforts to 4 key areas—kitchen, bath, hall, and child's bedroom—to conserve time and resources. We found it necessary to provide extensive training to the cleaning and carpentry crews, given the specialized nature of the work and the thoroughness required to decrease allergen levels. To augment effectiveness and promote sustainability, efforts were made to engage household members whenever possible in the intervention.

Third, to achieve long-term effects, we directed substantial effort into educating household members about IPM methods. We hired an experienced educator from the community to work one-on-one with household members to develop individualized strategies for pest control, such as removing garbage from the apartment each day, eating only in the kitchen, immediately cleaning up all food spills, recycling old clothes and papers, storing food in sealed containers, and washing dishes immediately after meals. Laminated information sheets were posted in each apartment to reinforce the key strategies selected for that household. We expanded the educational sessions from 1 to 5 and included as many household members as possible in the sessions. Among the practices we encountered that encouraged infestation by pests were flooding and cleaning of floors with string mops and leaving cups of water and food about the apartment.

Fourth, most of the participants reported using pesticides against cockroaches in their apartments at baseline. In addition, certain residents in the lagged-intervention group took it upon themselves to caulk and seal their apartments before our scheduled IPM intervention. (The consent form was necessarily thorough and explained the procedures that the participants could expect with our environmental intervention.) Other households asked if we would conduct the IPM intervention sooner than scheduled.

Finally, poor housing quality and lack of building maintenance complicated residents' ability to sustain the environmental improvements we made. One participant said that she would not take garbage to the basement at night because rats were present. Poor housing quality and unsafe building conditions were key challenges faced by field staff, who encountered doors that wouldn't close or lock, accumulated garbage in public spaces within the buildings, holes and cracks in the building envelopes, plumbing and steam heating leaks, and old appliances. Existing New York City ordinances regulate some of these conditions—for example, building owners are required to provide leak-proof containers for garbage disposal, remove garbage cans from common spaces each day, keep all dwellings in "good repair," and ensure that the premises are rodent and pest free and harborages are eliminated[5]—but we found that enforcement of these ordinances was often lax or absent.

NEXT STEPS

When follow-up measurements are completed, we plan to quantify any reductions in pest allergen levels found in the apartments following interventions, measures of allergen sensitization found among the participating children, or both. In addition, we will investigate whether or not lower allergen levels are related to fewer self-reported measures of asthma morbidity, notwithstanding the small number of participants in this study.

While interventions at the apartment level may be useful in reducing environmental triggers for asthma, interventions at the building, neighborhood, and city levels are needed to bolster these individual efforts to sustain pest-free environments. Notably, several of the participants in our study were residents of buildings where the tenants had organized and were lobbying New York City agencies for better enforcement of the existing building ordinances. ■

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HIGHLIGHTS

- Thorough environmental interventions to eliminate pests such as cockroaches and mice involve considerable inconvenience to household members, as they often span several days and severely disrupt household activities.
- Apartment-level environmental interventions may be effective in educating community residents about the environmental triggers of asthma and promoting communitywide efforts to decrease environmental hazards in the home.
- Educating household residents about pest control measures may be insufficient to sustain pest-free environments, owing in part to poor housing quality, limited maintenance of buildings, and lax enforcement of existing ordinances in impoverished communities.

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Contributors

P.L. Kinney, M.E. Northridge, E. Gronning, and E. Joseph drafted the first version of the report. G.L. Chew, J.C. Correa, I. Goldstein, and S. Prakash added to and edited the first version to produce the final report.

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References

1. Newacheck PW, Halfon N. Prevalence, impact, and trends in childhood disability due to asthma. *Arch Pediatr Adolesc Med.* 2000:154:287–293.

2. Rosenstreich DL, Eggleston P, Kattan M, et al. The role of cockroach allergy and exposure to cockroach allergen in causing morbidity among inner-city children with asthma. *N Engl J Med.* 1997:336:1356–1363.

3. Chew G, Miller RL, Frantz S, et al. Allergen intervention in low-income New York City apartments. *Am J Respir Crit Care Med.* 1999:159:A501.

4. Miller RL, Acosta L, Bell C, et al. Asthmatic children in Northern Manhattan both highly exposed and sensitized to cockroach allergens in comparison to dust mite, mouse, and rat. *Am J Respir Crit Care Med.* 199:159:A856.

5. City of New York Housing Maintenance Code, subchapter 2, articles 4 (Extermination and Rodent Eradication) and 5 (Collection of Wastes). Available at: http://www.housingnyc.com/resources/hmc/hmc.html. Accessed October 24, 2001.

Resources

The educational pamphlet *Why Indoor Air Quality is Your Problem Too* and project fact sheets on IPM are available from Juan Correa, MD, MPH, Mailman School of Public Health, Department of Environmental Health Sciences, 60 Haven Ave, B-1, New York, NY 10032 (e-mail: jcc67@columbia.edu).

The Web site for West Harlem Environmental Action, Inc (WE ACT) is at http://www.weact.org. Investigators at the Mailman School of Public Health of Columbia University and staff at WE ACT serve as formal partners in the Community Outreach and Education Program at the NIEHS Center for Environmental Health in Northern Manhattan (Mary E. Northridge, director; Peggy M. Shepard, codirector).